Things Expected of the Chemical Engineer

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Perhaps no question is so interesting to the student in a technical course as is the one which bears upon the things which are expected of him when he will have completed his college work and is ready to enter into the work in his chosen field. All this is best answered by studying the reasons which underlie a demand for men trained especially to work in this field.

Prior to the enormous development of modern industries the manufacturers produced his wares in a small factory, employing men who were highly skilled in manufacturing one special article. The business developed so slowly that there was always a supply of men capable of meeting demands long before places were available for them. Raw material was drawn from the same source and was practically uniform, or its change was so gradual that the workmen easily accustomed themselves to working it. With the great development in engineering, however, this was all changed. Civil engineers made sources of new material available which were fare remover and opened up new markets to the sources of raw material which could previously only supply the local demand. This gave the manufacturer new markets, or forced him to look elsewhere for materials. He soon found, however, that the raw materials were not uniform; those coming from different mines or mills had different impurities, or different treatments, all of which changed their properties. Furthermore mechanical engineers replaced the intelligent and skillful workman by a machine; often operated by an unskilled workman. The result of this was the introduction of specifications; contracts which would insure a product which would meet the requirements of the manufacturer. When bids were received they were accepted with the understanding that the materials would meet the requirements of the manufacturer according to specifications. In order that the receiver could be sure that the raw material would meet his requirements before he unloaded it; and in order that the producer could supply a material without having it rejected, sets of tests were devised. Frequently those were mechanical in their nature, but more generally they were chemical analyses of the raw material. It was rare that a complete analysis was necessary; if certain impurities were below a defined value the material could be accepted. Even a complete chemical analysis does not always signify that a raw material will serve, however; frequently the previous treatment is more vital to its properties than are its constituents. With the growth of those industries which use some chemical reactions to convert a material into a different form, there was also a demand for specially trained men to design, develop and operate them. This is the main function of chemical engineering.

Until quite recently this work was largely done by mechanical engineers who were well trained on the mechanical side, but were lacking in chemical knowledge; or by chemists who were skilled in the chemical work but were deficient in engineering knowledge. The course in chemical engineering—the youngest of the engineering courses—was added to supply men who would be suitable for this work.

The course as developed in most colleges is fairly uniform in the main points, though differing somewhat in main details. Enough English is given to enable the engineer to write accurate reports of his investigations and recommendations. Reports and specifications writing is one of the most important things which the chemical engineer has to do. A thorough training is given in inorganic, organic, and physical chemistry so that new or unusual conditions may be met. The training in analytical chemistry is such that the student can enter the works laboratory and quickly master the methods used at that place; the aim is, or should be, to give skill in manipulation and a training in general principles rather than a mastery of the schemes used in any special line of work. In teaching these points, however, it is generally thought best to select most of the practices from technically important substances, and to give as much technical analysis as the time will permit. In conjunction with the latter work, the proper interpretation of the analytical data is emphasized. The courses in technical chemistry cover, as much as possible, the methods used in chemical plant constructions; the types of machines, ovens, cells, etc., that are in general use; and problems are given which will illustrate important points, or will develop the students' research abilities. Enough technical drawing is given to enable the student to read the most complex technical trawing and to enable him to state his ideas in such a manner that they can be interpreted in the foundry and the shop. In mechanical engineering he is trained in such a manner as to be able to intelligently direct a power plant; to calculate the power needed in his operations and, after he has had a considerable practical experience, to enable him to design units, and to assemble an entire plant. Enough electrical engineering is given to enable him to use intelli-

gently the generator, the motor and the current and to adopt, or specify electric machinery suitable to his needs. One or two years of one of the more widely used foreign languages is included to give him access to a technical literature written in a language other than his own. The courses in machematics include a thorough training in the calculus. The courses in physics are fundamental, and go well into advanced mechanics. In many schools, it is thought wise to include enough military training to enable him to help defend his country if it becomes necessary.

While the above courses are the ones prescribed in the curriculum it is by no means all that the student is expected to get from his college training. The young man who graduates without gaining an appreciation of music, literature and the like and who has not fitted himself to be an enjoyable companion to others will have missed one of the most important—if not the most important—part of his college training. The matter of personality is extremely important. Employers demand this, and it is seldom that a man is selected for a position which has much of a future without first having had some personal intercourse with the employer. One employer wrote: "Send me a man with whom I can be comfortable; I can soon teach him all he needs to know myself." Another wrote: "We expect to develop the person we select into a manager of our plant, and we want someone who can get along with our men."

After graduation it is a problem to decide on the kind of work to select, if one has a choice in the matter. It is a deep seated conviction among chemical engineers that the young chemical engineer should receive his initiation into the fraternity through the laboratory, where the routine work is done. Only a few years should be spent here, however, and if the candidate cannot get out in a reasonable time he is "a square plug in a round hole" and should enlist in some other endeavor. While in the laboratory he will have an opportunity to familiarize himself with the workings of the entire plant. The "testing" or "control" laboratory fits him for the positions which the chemical engineer generally fills. He may become the chief chemist. In this capacity he will be expected to specify the kinds of raw material wanted; to digest the tests which his assistants make, and to decide whether or not the materials conform to the specifications. It is not an uncommon thing to accept, or reject, single consignments which are valued at hundreds of thousands of dollars on the tests which are made in the laboratory. On the other hand the materials being worked in the factory are carefully tested at various stages, and such information is supplied as will enable the managers to produce a uniform product which will meet the specifications of its buyers. The chief chemist is also expected to select the tests which are used, and to devise new ones if necessary. It has come to be quite common to select members of the sales department—the most important department from the manufacturer's standpoint—from the laboratory. It is quite evident that products of a chemical nature require a trained chemist to properly exploit them. The purchasing departments of many plants are controlled by the laboratory. Managers of chemical and metallurgical plants are, at present, largely selected from the laboratory. This part of the work is very enjoyable, and the remuneration is generally high. The research department is perhaps the most popular among chemical engineers. When an inquiry is made for a research man the effort is made by most colleges to supply one of the graduates of some previous year who has had experience along the line for which the research is required. Inexperienced graduates are not generally successful in this line of work, and it is best to approach this work from the testing laboratory. The research chemist is expected to improve old processes; cheapen the product or make it better; develop new processes; and perfect old machines or design new ones. In some plants two or more of these departments are under the control of a single man.

The writer wishes to congratulate the editors and managers of this magazine on their efforts; and to wish them the greatest success obtainable.